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A buffer-gas trap for the NEPOMUC positron beam: optimization studies with electrons

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We outline the design and operation of a buffer-gas trap (BGT) for the NEPOMUC positron beam. BGTs use inelastic interactions with nitrogen molecules to efficiently capture positrons from a continuous source. They are invaluable for high-resolution studies of matter-antimatter interactions, antihydrogen research, and positronium laser spectroscopy. The device has been assembled at IPP Garching and successfully tested to produce bunches of up to 10^8 particles using an electron beam with a similar intensity and energy spread to the remoderated NEPOMUC beam. The non-neutral plasma that accumulates in the trap can be ejected in a 100 ns-long pulse at rates of between 0.01 to 10 Hz. The BGT is expected to extend the capabilities of the NEPOMUC by offering dense pulsed positron beams with narrow energy spreads (< 100 meV). The device is a vital component of the APEX (A Positron Electron eXperiment) project, which aims to produce a low-energy electron-positron pair plasma.

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